

Claims Listing

1 1. (previously presented) A method of testing an optoelectronic device including a
2 VCSEL, said VCSEL having a cavity resonator formed by a relatively low reflectivity frontside
3 reflector and a relatively higher reflectivity backside reflector, comprising the steps of:
4 at an intermediate stage of its assembly, measuring an optical signal leaking through
5 said backside reflector of said VCSEL,
6 determining from the measured signal whether a selected quality of said VCSEL
7 meets a predetermined specification, and then
8 finishing said device in a configuration designed to use radiation emitted from
9 said frontside reflector of said VCSEL.

1 2. (previously presented) The invention of claim 1 wherein said measuring step includes
2 aligning a probe with said device and then measuring radiation leaking from backside reflectors
3 of a multiplicity of VCSELs without performing another act of aligning said probe.

1 3. (previously presented) A method of testing a bottom-emitting VCSEL array at an
2 intermediate stage of its manufacture, the VCSEL array including VCSELs each having a cavity
3 resonator formed by a relatively low reflectivity frontside reflector and a relatively higher
4 reflectivity backside reflector, comprising the steps of:
5 aligning a probe with one side of said VCSEL array, said probe including electronic
6 circuits coupled to each of said VCSELs for causing said VCSELs to emit radiation and
7 including photodetection circuits coupled to each of said VCSELs for detecting radiation leaking
8 through each of said backside reflectors,
9 without performing another act of aligning said probe, determining from said detected
10 backside radiation whether a selected quality of each VCSEL meets a predetermined
11 specification, and then
12 for those VCSEL arrays that meet specification, finishing their manufacture in a
13 configuration designed to use radiation emitted from said frontside reflectors.

1 4. (previously presented) The invention of claim 3 wherein said intermediate stage

2 includes fabricating said VCSEL array on a substrate and said aligning and determining steps are
3 performed without removing said substrate.

1 5. (previously presented) The invention of claim 4 wherein said finishing step includes
2 removing said substrate before final assembly.

1 6. (currently amended) A method of testing a bottom-emitting VCSEL array at an
2 intermediate stage of its manufacture, the VCSEL array including VCSELs each having a cavity
3 resonator formed by a relatively low reflectivity frontside reflector and a relatively higher
4 reflectivity backside reflector, comprising the steps of:

5 aligning a probe with said VCSEL array, said probe including a first array of electronic
6 circuits coupled to one side of said VCSEL array and to each of said VCSELs for causing said
7 VCSELs to emit radiation and including a second array of photodetection circuits, including
8 photodetectors coupled to an opposite side of said VCSEL array and to each of said VCSELs for
9 detecting radiation ~~leaking~~ emitted through each of said ~~backside~~ frontside reflectors,

10 without performing another act of aligning said probe, determining from said detected
11 ~~backside~~ frontside radiation whether a selected quality of each VCSEL meets a predetermined
12 specification, said determining step including energizing said electronic and photodetection
13 circuits in a fashion to reduce cross-talk between VCSELs and each photodetector, and then

14 for those VCSEL arrays that meet specification, finishing their manufacture in a
15 configuration designed to use radiation emitted from said frontside reflectors.

1 7. (previously presented) The invention of claim 6 wherein said VCSELs are energized
2 in a first predetermined sequence and said photodetection circuitry is energized in a second
3 predetermined sequence so as to reduce cross-talk.

1 8. (previously presented) The invention of claim 7 wherein all of said VCSELs are
2 energized concurrently, but said photodetection circuits are energized in a sequence that reduces
3 said cross-talk.

1 9. (previously presented) The invention of claim 8 wherein said photodetection circuits

2 are energized in a sequence that turns on a particular one of said circuits while concurrently
3 turning off circuits adjacent thereto.

1 10. (previously presented) The invention of claim 7 wherein all of said photodetection
2 circuits are energized concurrently, but said VCSELs are energized in a sequence that reduces
3 said cross-talk.

1 11. (previously presented) The invention of claim 10 wherein said VCSELs are
2 energized in a sequence that turns on a particular one of said VCSELs while concurrently turning
3 off VCSELs adjacent thereto.

1 12. (previously presented) The invention of claim 7 wherein first groups of said
2 VCSELs are energized in said first sequence and second groups of said circuitry are energized in
3 said second sequence, with VCSELs in each of said first groups being energized concurrently
4 with one another and circuits in each of said second groups being energized concurrently with
5 one another.

1 13. (previously presented) The invention of claim 6 wherein said intermediate stage
2 includes fabricating said VCSEL array on a substrate and said aligning and determining steps are
3 performed without removing said substrate.

1 14. (previously presented) The invention of claim 13 wherein said finishing step
2 includes removing said substrate before final assembly.

1 15. (previously presented) Apparatus for testing an optoelectronic device at an
2 intermediate stage of its manufacture, said device including a VCSEL having a cavity resonator
3 formed by a relatively low reflectivity frontside reflector and a relatively higher reflectivity
4 backside reflector, said apparatus comprising:

5 a probe including a photodetection circuitry for measuring an optical signal leaking
6 through said backside reflector of said VCSEL, and

7 means for determining from the measured signal whether a selected quality of said

8 VCSEL meets a predetermined specification.

1 16. (previously presented) The invention of claim 15 further including means for
2 aligning said probe with said device just once and wherein said photodetection circuitry
3 measures radiation leaking from backside reflectors of a multiplicity of said VCSELs.

1 17. (previously presented) Apparatus for testing a bottom-emitting VCSEL array at an
2 intermediate stage of its manufacture, the VCSEL array including VCSELs formed on a
3 substrate, each VCSEL having a cavity resonator formed by a relatively low reflectivity frontside
4 reflector and a relatively higher reflectivity backside reflector, said apparatus comprising:
5 a probe including electronic circuits coupled to each of said VCSELs for causing said
6 VCSELs to emit radiation and including photodetection circuits coupled to each of said VCSELs
7 for detecting radiation leaking through each of said backside reflectors,
8 means for aligning said probe just once with one side of said VCSEL array, and
9 means for determining from said detected backside radiation whether a selected quality of
10 each VCSEL meets a predetermined specification.

1 18. (previously presented) The invention of claim 17 wherein said aligning means and
2 determining means function without removing said substrate.

1 19. (previously presented) Apparatus for testing a bottom-emitting VCSEL array at an
2 intermediate stage of its manufacture when its substrate is intact, the VCSEL array including
3 VCSELs each having a cavity resonator formed by a relatively low reflectivity frontside reflector
4 and a relatively higher reflectivity backside reflector, said apparatus comprising:
5 a probe including a first array of electronic circuits coupled to one side of said VCSEL
6 array and to each of said VCSELs for causing selected ones of said VCSELs to emit radiation
7 and including a second array of photodetection circuits, including photodetectors coupled to an
8 opposite side of said VCSEL array and to each of said VCSELs for detecting radiation ~~leaking~~
9 emitted through each of said ~~backside~~ frontside reflectors,
10 means for aligning said probe just once with said VCSEL array, and
11 means for determining from said detected ~~backside~~ frontside radiation whether a selected

12 quality of each VCSEL meets a predetermined specification, said determining means including
13 means for energizing said electronic and photodetection circuits in a fashion to reduce cross-talk
14 between VCSELs and each photodetector.

1 20. (previously presented) The invention of claim 19 wherein said probe energizes said
2 VCSELs in a first predetermined sequence and said photodetection circuitry in a second
3 predetermined sequence so as to reduce cross-talk.

1 21. (previously presented) The invention of claim 20 wherein said probe energizes all of
2 said VCSELs concurrently, but energizes said photodetection circuits in a sequence that reduces
3 said cross-talk.

1 22. (previously presented) The invention of claim 21 wherein said probe energizes said
2 photodetection circuits in a sequence that turns on a particular one of said circuits while
3 essentially simultaneously turning off circuits adjacent thereto.

1 23. (previously presented) The invention of claim 20 wherein said probe energizes all of
2 said photodetection circuits concurrently but energizes said VCSELs in a sequence that reduces
3 said cross-talk.

1 24. (previously presented) The invention of claim 23 wherein said probe energizes said
2 VCSELs in a sequence that turns on a particular one of said VCSELs while concurrently turning
3 off VCSELs adjacent thereto.

1 25. (previously presented) The invention of claim 20 wherein said probe energizes first
2 groups of said VCSELs in said first sequence and second groups of said circuitry in said second
3 sequence, with VCSELs in each of said first groups being energized concurrently with one
4 another and circuits in each of said second groups being energized concurrently with one
5 another.